

GSM Based Automatic Substation Load Shedding

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Abstract- Aim of this paper is designed to control substation load shedding and sharing using a programmable switching control automatically. In this paper this is demonstrated using a microcontroller. The development of this application requires the configuration of the program through GSM module. In substation, there are many tasks like certain loads need to be switched on/off in specific time intervals. In this, the loads can be operated in three modes: Set mode, Auto mode and Manual mode. In set mode, through timers, the operation is based on input time set by the user where as in auto mode it works on default time settings and finally in manual mode it functions while respective loads are operated depending on the load necessity using GSM. All the modes and status of loads are displayed on LCD. Finally GSM modem which sending SMS to the control system can select the mode and timing remotely.

Index Terms- Automatic substation load shedding (ASLS), Global positioning system (GPS), and Global system for mobile (GSM).

INTRODUCTION

Controlling of electric power substation equipment plays an important role in daily maintenance of electric power system. In an extra high voltage substation, the reliability required from substation components is critical. Applications of controlling base station with the help of mobile of substation equipment could improve the quality of accelerating the process of any substation. Main aim is to control the substation equipment through a mobile phone. Here GSM based modem technology is used and connected end-to-end, with one end to the distribution side and other to the mobile device. The mobile device used here makes the control of equipment of the substation on a global basis. Here the system is going to control the distribution side equipment switch gear and relays.

II. BLOCK DIAGRAM

The functionality of the ASLS system involves in to following steps. Block diagram is shown in figure 1. In this block diagram the GSM sends SMS to the controller through max 232 then the controller performs the operation by reading the message i.e. controller gives signal to the relay driver that controls the feeder.

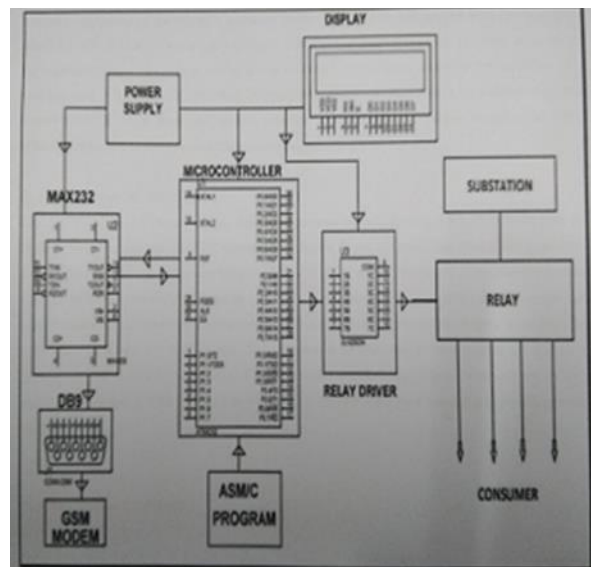


Figure 1: Block diagram of GSM based automatic substation load shedding.

The main blocks of this are:

1. Micro controller (AT89S52)
2. Level Shifter IC MAX232
3. Relay Driver ULN2003
4. Electromagnetic relay
5. LCD
6. GSM modem.
7. EEPROM.
8. MAX232.
9. Power supply.

AT 89S52 Micro controller

It is a low power, high performance, inexpensive CMOS 8-bit microcontroller with 8K bytes of in system programmable flash memory.

Level Shifter IC MAX232

It is an integrated circuit that converts signals from an RS-232 serial port to signals suitable for use in TTL compatible digital logic circuits. It is a dual driver/receiver and typically converts the RX, TX, CTS and RTS signals.

Relay Driver ULN2003

It is a high voltage high current Darlington transistor array containing seven open collector Darlington pairs with common emitters. it uses common cathode clamp diodes for switching inductive loads.

Electromagnetic Relay

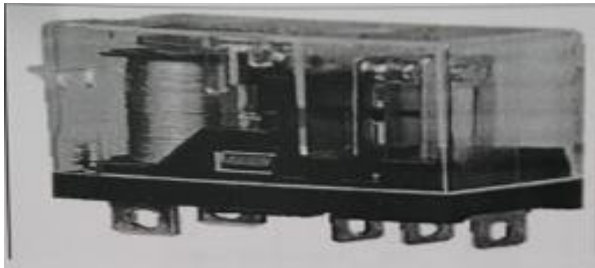


Figure 2: Electromagnetic Relay

It is used to isolate two circuits electrically and connect magnetically. Thus a small sensor circuit can drive equipment like fan, bulb etc. and protects them. It closes the circuit when the relay is activated. It disconnects the circuit when the relay is inactive. The output parts are normally closed contact (NC) and Normally Open Contact (NO).

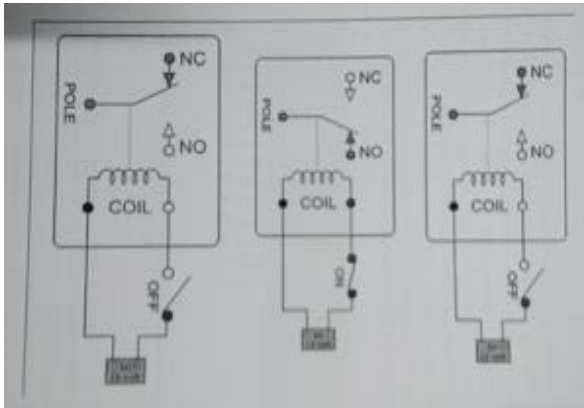


Figure 3: Electromagnetic Relay NC NO Operation
LCD Liquid crystal display consists of rod shaped tiny molecules sandwiched between a flat piece of glass and an opaque substrate. The alignment changes depends on electricity applied across. They pass or block the light depending on electricity passed. It is basically a 16x2 LCD.

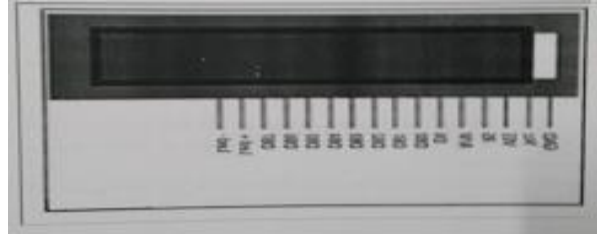


Figure 4: LCD Liquid Crystal Display

GSM SIM 900 module has been chosen to achieve the SMS functionality. It has the facility to read the received message. Written program will control messages without any hardware changes.

EEPROM It is secondary storage device that once written (programmed) can hold data even when the power is removed. Used in computers and other electronic devices to store small amounts of data that must be saved when power is removed.

MAX232 is a very common IC basically required for interfacing controller to PC, GSM module, GPS module, Bluetooth module, Wi-Fi module. It converts RS232 voltage level to TTL voltage level.

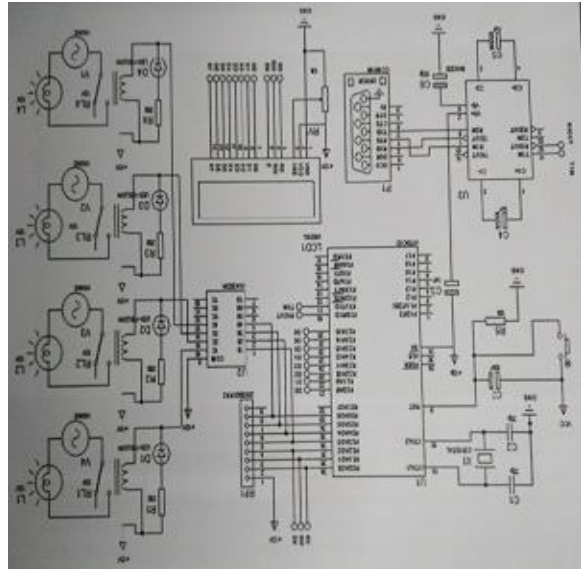


Figure 5: Main circuit diagram of GSM based automatic substation load shedding.

III. ADVANTAGES AND DISADVANTAGES

3.1 ADVANTAGES

1. Reduces manpower.
2. Quick implementation of work.
3. Power saving and management.
4. Reduce overloading.

3.2 DISADVANTAGES

1. Initial installation cost is high.

2. Damages in relay system will not work.

IV. APPLICATIONS

1. Used in industry for power supply substations.
2. Used in railway substations power supply.
3. Urban and rural areas substations operation and control.

V. RESULTS

The paper “GSM based automatic substation load shedding” was designed such that to operate and control the equipment remotely. The commands like “Turn on load 1”, “Turn ON”, “Turn OFF” the user can send a single number command. These numbers can be set by user. A single controller can control up to 28 loads. The circuit diagram can be designed using Proteus v7.7 simulator software or else on PCB (Printed Circuit Board).

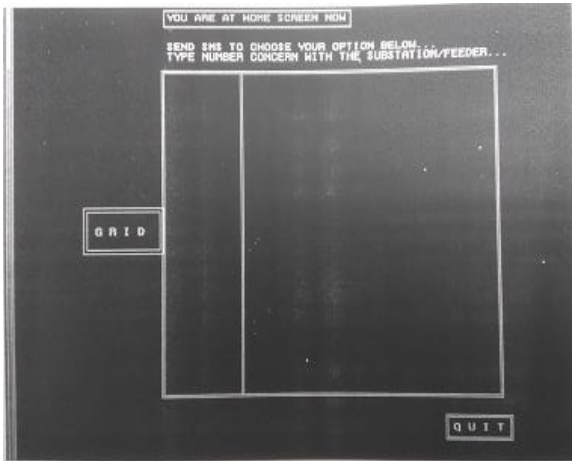


Figure 6: Simulation results welcome screen.

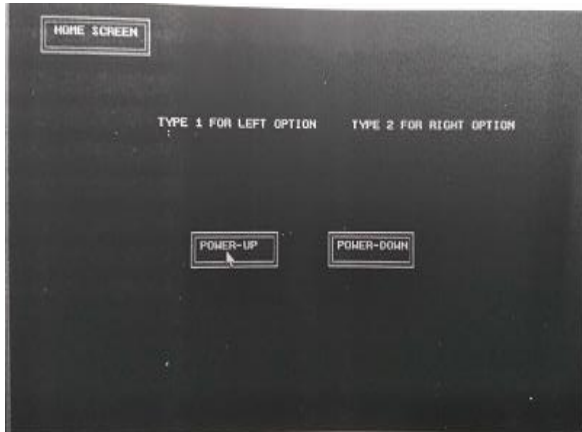


Figure 7: Simulation results Turn On / Turn OFF screen

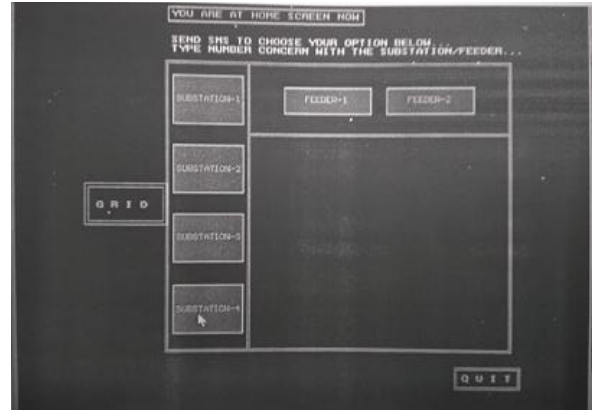


Figure 8: Simulation results Activate Generators and Feeders Remotely.

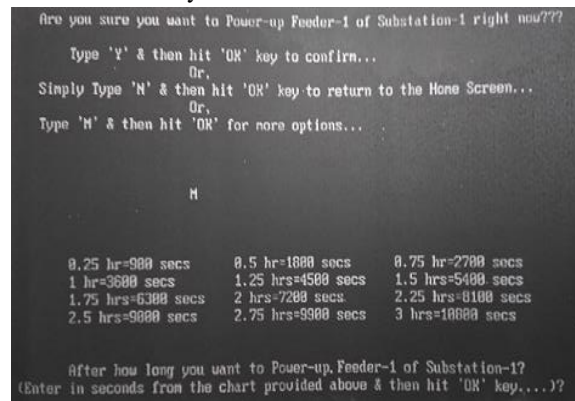


Figure 9: Simulation results Selection of Time period of power off.

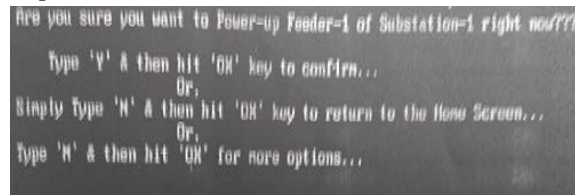


Figure 10: Simulation results Confirmation of Power On/Off

VI. CONCLUSION

According to the proposed system the host can be any cell phone and the client is a controller based on Atmel AT89S52. This controller is connected to a GSM modem through an RS232 cable and a level shifter IC. The paper provided explanation of circuit diagram can be designed using Proteus v7.7 simulator software or else on PCB (Printed Circuit Board). The proposed system is economical and efficient in comparison with the similar systems developed so far.

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