

# INTELLIGENT POWER DISTRIBUTION SYSTEM WITH GSM CONTROL

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**Abstract** - The objective of the paper is to provide the continuous power supply to the consumer and provide the safety from the distribution power system to the working person who works with the distribution system. Where the system has two major parts according to the appliance as follows, GSM control unit and an automated power line switching unit. Then the proposed system has two types of power lines such as the main feeder and an auxiliary feeder. The auxiliary feeder is used to transmit the power at maintenance or faulty condition of the main feeder. In this proposed system, the GSM control unit provides the facility to switch the feeder by using an SMS (Short Message Service) without direct contact with a power line and the automatic power line switching unit is used to switch the electric power to the auxiliary feeder in an automatic manner, when the main feeder in faulty condition. And also which proposed system sends fault alert to the respective person at when the fault occurs in the distribution system to rectify the fault rapidly in the system.

**Key Words:** Solid State Transfer Switch (SSTS), Controller, Liquid Crystal Display (LCD), Global System for Mobile Communication (GSM/GPRS), and Measuring Relay circuits.

## 1. INTRODUCTION

Nowadays, industries meet severe problems due to the interruption of power supply from the line to ground fault, which leads to a failure of transmission and distribution system. Once the failure occurs in a transmission or distribution system at the time estimating the location of the fault is a difficult thing and also fault clearing takes a lot of time. We know that the productivity of small industries based on the availability of electric power. So, we need to provide electricity to the small industries in an effective manner to develop the economic condition of the country. On another hand, some difficulties available in switching the power supply between the feeders or transmission lines. Up to nowadays, AB switches are commonly used to switching the power supply by using human power. Which leads to electric shock due to touch the potential phenomena in the switching circuit. So, the objective of the paper is providing a continues power supply by using an auxiliary feeder with automated power line switching unit and ensure the safety of human while in switching action with help of GSM control unit. The automatic power line switching unit gets the information from the different types of relay circuits to monitor the transmission and distribution network for

performing the respective action to provide the continues power supply. The GSM communication is the worldwide range of communication, so we can change the power flow in an electrical network where ever from in this world by using our GSM control unit.

## 2. RELATED WORK

The protection scheme of the double circuit transmission line based on an artificial neural network (ANN) has been proposed [1]. Optimal Coordination of Automatic Line Switches for Distribution Systems [2] Author focuses on distribution feeder automation system. Overhead Line Protection With Automatic Switch By Using Plc Automation [3] Author focus to implement the main objective of his project is to prevent overloading of the transmission line using the current sensor. Internet and wireless communications have also been utilized in parallel with GSM for home automation [4]. Among the cellular technologies, GSM network is preferred for the communication between the home appliances and the user due to its widespread coverage [5]. For the power, system design and analysis power flow analysis is used and MATLAB programming is used for software package [6]. Conventional single pole and three phases auto-reclosing techniques applied to extra high voltage (EHV) transmission lines adopt fixed time interval reclosure techniques [7]. Controlled switching has been a desirable method for stress reduction and in particular for reduction of switching overvoltages, becoming an issue of widespread interest to the utilities and manufacturers [8]. Transmission and distribution substations are installations where the voltage, phase or other characteristics of the electrical energy are changed as part of the final distribution process [9].

## 3. BLOCK DIAGRAM AND DESCRIPTION

Here each unit of the system will be classified according to the performance of the parts of a system such as automatic power line switching unit, GSM control unit and switched-mode power supply. The overall block diagram of the system shown in Figure (1).

### 3.1 Automatic Power line Switching Unit

Automatic power line switching unit gets the information from the relay circuits to monitor the overall distribution system performance. It has the following parts such as a

microcontroller (1), relays, Solid State Transfer Switch, LCD controller and LCD display. The microcontroller (1) is used to control and monitor the distribution system and the LCD controller is used to show the current information about the system in the LCD display. Where the timer is used to achieve a specific switching action within a specified time interval. In this proposed system can make synchronized switching action according to the program in a microcontroller with help of a timer.

### 3.2 GSM control Unit

The GSM control unit has another microcontroller (2) and GSM /GPRS V3 module. This GSM technology is used to send and receive the SMS in this proposed system. When the fault occurs in the system such time automatic power line switching unit changes the power into the auxiliary feeder/transmission line. Such time this GSM control unit sends the fault information to the respective person. And also which unit used to change the power line by using SMS at the maintenance time of an electrical network. The microcontroller (2) is used to execute the above mentioned all things.

### 3.3 Switched-Mode Power Supply

The switched-mode power supply unit is used for rectification and provides the required amount of power supply to the all components such as automatic power line switching unit and GSM control unit, because where all the components are working with different power range in a form of DC supply. So the switched- mode power supply is the suitable one, to provide a power supply to achieve better performance from the automatic power line unit and GSM control unit.

From the above diagram shows the connection and communication between all components. Where the above diagram load (L1) is the industry (or a consumer area) and circuit breakers/switching circuits are mentioned in the form of C.B-S.W. The above-mentioned block diagram shows the single industry power transmission with parallel feeder mechanism. The proposed system can manage up to ten industries in an effective manner.

### 4. EXISTING METHODOLOGY

Electricity is the most important factor in the industries, according to this approach we know that the productivity of the industry based on the availability of electricity. So the objective of the proposed system is to provide a continues electricity to industries in an effective manner and also ensuring the safety of the working person who works with the distribution system.

Here, the proposed system has a two feeder to provide the electricity to the industries such as Main feeder and Auxiliary feeder. At normal operating condition electricity only flows through the main feeder. The behavior of the proposed system is monitored with help of microcontroller (1) and different types of the relay. And also monitored information is shown in LCD display by using display controller.

When a fault occurs on the main feeder operation, which is sensed by the microcontroller (1) then the power supply will be switched to the auxiliary feeder in an automatic manner for providing a continuous power supply to the industry with help of switching devices (Solid State Transfer Switch-SSTS). Then the system sends the fault information in the form of SMS to the respective person who is the in-charge of the distribution system with help of GSM technology for clear the fault on the respective feeder in a frequent manner. In this condition information about the faulty feeder is shown in LCD display with help of LCD controller. The timer is used to achieve the synchronized switching action in this proposed system. According to the above-mentioned approach we can provide continuous power supply to industries and also monitoring of the power system becomes wide range with help of GSM technology.

In the distribution system, manual switching action of the power supply is an essential one at the maintenance time. In many areas, AB switches are used to achieve the switching action, which is sometimes leading an electric shock. And also we know that Remote switching action only possible in local area control. So, the GSM control unit is introduced in this system to ensure the safety of the working person from the electric shock who works with the distribution system and achieve the worldwide control facility.

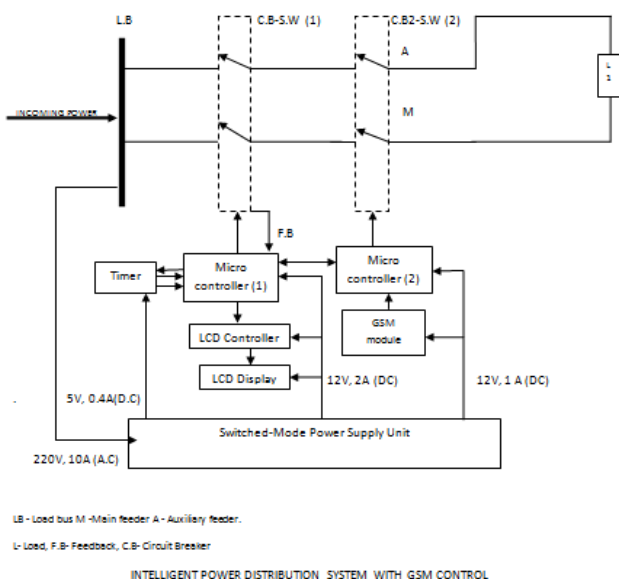


Fig. 1 Block diagram of the system

From the represented block diagram of the system, GSM control unit has an individual microcontroller (2), GSM module and separate switching circuit (SSTS) to achieve the independent performance from the automatic power line switching unit. When the working person wants to change the power supply due to the personal requirement, such time he sends the SMS to the proposed system to achieve the required switching action. In this unit, the GSM module is used for the communication purpose and microcontroller (2) is used to process the received SMS to process and execute the required action according to the SMS information. The overall function of the proposed system shown in figure 2.

This system has Switched-Mode power supply to provide the power supply for different type's equipment in the proposed system.

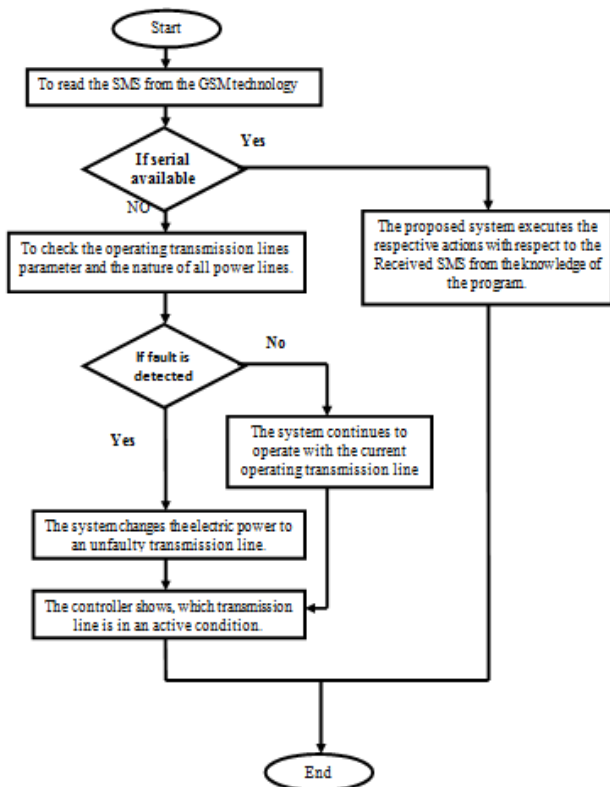


Fig.2 Flowchart representation of the proposed system.

From the above flowchart representation GSM control unit has first priority to supply the electric power to the industry. So, the manual switching through the GSM technology is reliable and more effective. This proposed system can monitor ten feeders at the same time.

### 5. PROPOSED AUTOMATION SYSTEM

The Proteus 8 software is used to simulate the proposed idea of the system. Here the proposed system mainly classified according to the performance of parts in each unit.

- ✓ Automatic power line switching unit
- ✓ GSM control unit

Note: Here, proposed simulation diagrams represent the distribution system for two industries and also each industry is represented in the form of a lamp.

### 5.1 Automatic power line switching unit:

In this proposed system has two feeders to provide an uninterrupted power supply to the industries. At normal operating condition power supply only flows through the main feeder. When a fault occurs on the main feeder such time only power supply switched into the auxiliary feeder. The automatic power line switching unit has a microcontroller(1) to achieve the continuous monitoring of the distribution system. Which gets parameters about the distribution system from the different types of relay circuits. And also which is paralleled with GSM control unit to send the SMS to the respective person at the fault situations.

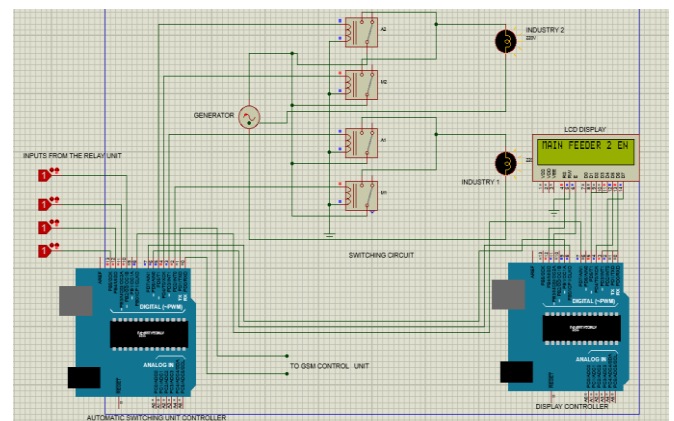
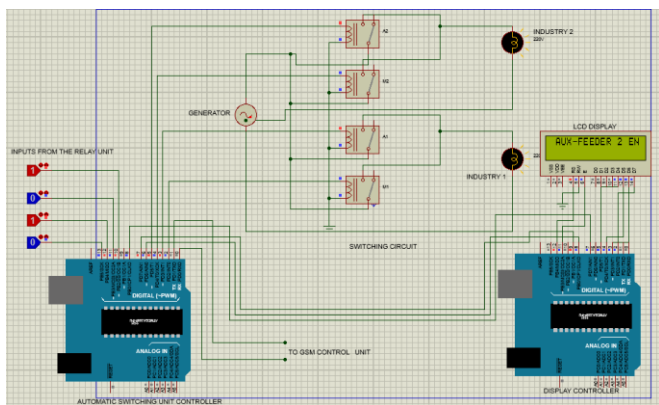


Fig.3 Automatic power line switching unit at the normal operating condition.

The above-mentioned Figure (3) represents the circuit connection and performance of the automatic power line switching unit at the normal operating condition. When no-fault takes place on the distribution system such time which system gets positive logic of inputs from the relay circuits. So the power supplies troughs only on main feeders (M1, M2) to the respective industries/consumer. In this condition the proposed system displays on LCD display such as "MAIN FEEDER 1 EN" and "MAIN FEEDER 2 EN" with help of LCD controller.

If the fault is detected by the relay circuit on the main feeders (M1, M2) operation, such time the automatic power line switching unit transfers the electric power to the auxiliary feeders (A1, A2). And also which system sends the fault alert to the respective person with help of GSM control unit. The following figure (4) describes the function automatic power line switching unit when the fault occurs on both main feeders.



**Fig.4** Automatic power line switching unit at both feeders is in a failure condition.

In this condition which system shows in LCD display “AUXILIARY FEEDER1 EN” and “AUXILIARY FEEDER2 EN” with help of LCD controller. Thus the overall function of the automatic switching unit for two industries distribution system modal was described in the form of tabulation in Table (1).

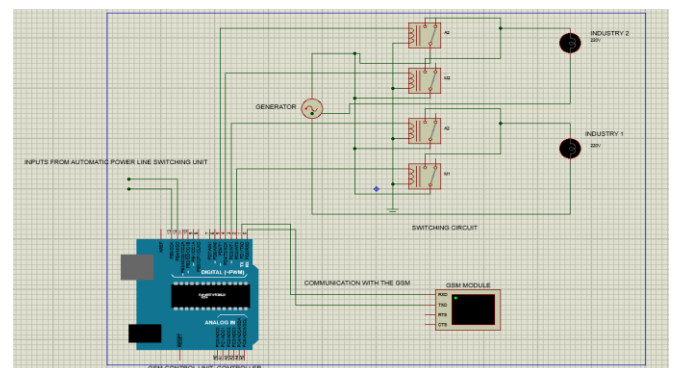
**Table1.**

INPUTS FROM THE RELAY				POWER FLOW ON THE FEEDERS			
I1	I2	I3	I4	M1	A1	M2	A2
0	0	0	0	0	0	0	0
0	0	0	1	0	0	0	1
0	0	1	0	0	0	1	0
0	0	1	1	0	0	1	0
0	1	0	0	0	1	0	0
0	1	0	1	0	1	0	1
0	1	1	0	0	1	1	0
0	1	1	1	0	1	1	0
1	0	0	0	1	0	0	0
1	0	0	1	1	0	0	1
1	0	1	0	1	0	1	0
1	0	1	1	1	0	1	0
1	1	0	0	1	0	0	0
1	1	0	1	1	0	0	1
1	1	1	0	1	0	1	0
1	1	1	1	1	0	1	0

When the feeder in good operating condition at the time relay circuit sends positive logic (1) to the automatic power line switching unit.

### 5.2 GSM control unit:

The GSM control unit is a part of the system, which is capable of sending and receiving the SMS by using GSM module. It provides the facility to control the distribution system according to the requirement of the user by sending the SMS to the GSM module. It is very useful to the respective person who works with the distribution system. This has an individual controller and switching circuits to implement the required actions. The following diagram (5) represents the GSM control unit circuit diagram.



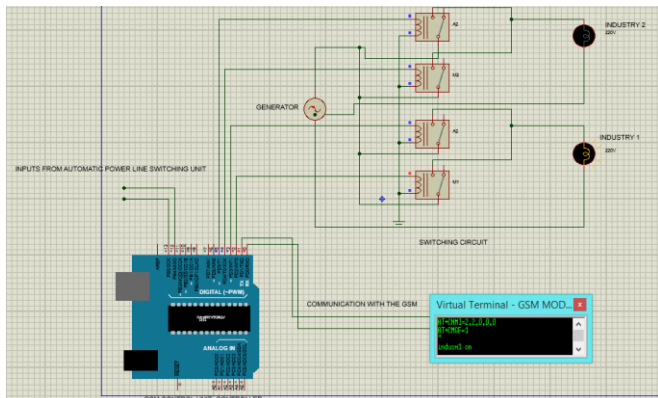
**Fig. 5** GSM control unit circuit diagram.

Here the performance of the system is programmed in the controller like an automatic power line switching unit for each comment as per the required in the GSM control unit. This GSM module provides worldwide control facility so we can control the distribution system where ever from this world. This is secured from the unauthorized persons when we use proper condition loop for the mobile number checking program. When we implement the following loop with GSM control unit, such time this system checks the mobile number and it can identify which message is received from an authorized person or not.

```
char phone_no[]="+*****";
void receiveSms(const char * number ,const char * text)
{
if(!strcmp(number, phone no)) /*Mobile number verification
{
// A body of the system program
}
}
```

When the GSM control unit receives SMS from the authorized person mobile number as like “#SRN.indus1 on”. Such time power flow takes place only on first industry main feeder.

Which is clearly shown in the following simulation diagram (6).



**Fig. 8** Simulation diagram for fire issue condition of the proposed control and operational unit.

Similarly, the overall control strategy of the proposed two industries distribution system described in the form of tabulation with respective comment model in the following Table (2).

**Table (2).**

SMS COMMENT	POWER FLOW ON THE FEEDERS			
	M1	A1	M2	A2
-	M1	A1	M2	A2
#SRN.indusm1 on	1	0	0	0
#SRN.indusm2 on	0	0	1	0
#SRN.indusa1 on	0	1	0	0
#SRN.indusa2 on	0	0	0	1
#SRN.indusa12 off	1	0	1	0
#SRN.indusm12 off	0	1	0	1
#SRN. All off	0	0	0	0
#SRN.indusm12 on (or) #SRN. All on	1	0	1	0

Which system has the following constraints :

- We need an auxiliary power supply to drive the overall proposed system.
- We need to perform much calculation and large program structure with respect to the number of feeders connected in the distribution system.

### 6. ADVANTAGE OF THIS APPROACH

- Cost is less for both implementation and maintenance.
- This technology ensures the safety of the worker in the distribution system.

- GSM technology is the time-saving thing to control the distribution system where ever from.
- It is more compact, simple and user-friendly.
- We can achieve a strong signal by adding additional antenna with the GSM module.
- Better performance and accuracy of the system can be achieved by adding more sensing relays with the proposed system.
- The LCD display was used to show the current situation of the industry distribution system.
- The timer is used to achieve the required actions within a specific time interval.

### 7. CONCLUSION

This paper is prepared to achieve an intelligent power distribution system with GSM control from the conventional distribution system. Here proposed methodology of the distribution system ensures the continuous power supply to the industries/customer and workers safety who work with the system. This intelligent power distribution system is economical, simple, efficient, compact, fast and user-friendly. Using GSM technology to send the fault alert message to the respective person is most suitable, wide availability, good coverage, and being cost effective. And also proposed GSM, SMS control strategy is a new thing for a distribution system. Here solid-state transfer switches are used to control the power flow in the distribution system, which is more reliable than others. I hope proposed all the methods are effective and more suitable to achieve the intelligent power distribution system.

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