ABSTRACT: At present days we can see that there is problem in the Electric power generation due to shortage of rain fall and availability of fuel. Due to the shortage of power generation it has become very important to make proper maintenance in power distribution network where power consumption is more. We also have to strictly eliminate power theft, overload and voltage fluctuation in the power lines. The Electrical power line is distributed in the form of network for proper power distribution. There will be feeders in the network between the power station and nodes. If there is a break down due to problems in the power transmission line between the node and base station, then there will be huge loss especially in the Industrial area. To avoid this loss in the industrial areas we should be able to sustain the power supply all the time without any break down and present days in the main line we cannot detect power theft, due to this Electrical Board (EB) is meeting a huge loss. The proposed method can be used to make distribution network automation by switching the feeders automatically and to find the voltage fluctuation and power theft in the power lines. And also to indicate fault detection in the power lines using GSM.

Keywords—GSM modem, Digital energy meter, Pulse Generator, Microcontroller.

I. INTRODUCTION

Electrical power is essential in all walks of life. However, the generated electric power not may be fully utilized if cannot be efficiently and effectively distributed.

As an effective approach of fault location, Fault Passage Indicator (FPI) is widely used in the distribution. Currently, most of the FPIs can only indicate the fault, and the fault location still depends on manual line inspection. The FPI with communication function can upload the fault data to the master station for automatically fault location, which considerably reduced the location time [1].

The main function of feeder automation system is on the basis of accurate locating fault to realize fault isolation and restore power supply of non-fault zone automatically. [2]

The word Automation means doing the particular task automatically in a sequence with faster operation rate. This requires the use of microprocessor together with communication network and some relevant software programming [3].

The paper discusses to make distribution network automation by switching the feeders automatically, to find the voltage fluctuation and power theft in the power lines. And to indicate fault detection in the power lines using GSM.

Application and Advantages:

1. We can detect the voltage fluctuation and correct it.
2. It detects the Power Theft in the Power line between Substation and node and updated the same information to Sub Station.
3. We have wireless transmission between feeder station and Sub Station, due to this cost of data transmission will be reduced.
4. If there is major problem in the power line then particular line related feeder will be opened.
5. Fault detected joint will be isolated for further work which should be done by line man.
6. Automatically switched to other feeder to provide temporary power on the line until line man clear the fault.
7. Trouble shooting in the faulty line will be Faster.

II. MODERN DISTRIBUTION SYSTEMS

A modern distribution system is shown in Figure.1. Modern power grids are extremely complex and widespread. Surges in power lines can cause massive network failures and permanent damage to multimillion-dollar equipment in power generation plants.

After electricity is produced at power plants it has to reach the customers who use the electricity. As generators spin, they produce electricity with a voltage of about 25,000 volts. The transmission and distribution system delivers electricity from the generating site to residential, commercial, and industrial facilities. [4]

Conductors for distribution may be carried on overhead pole lines or in densely-populated areas where they are buried underground. Urban and suburban distribution is done with three-phase systems to serve residential, commercial and industrial loads.
Only large consumers are fed directly from distribution voltages: most utility customers are connected to a transformer, which reduces the distribution voltage to the relatively low voltage used by lighting and interior wiring systems. The transformer may be pole-mounted or set on the ground in a protective enclosure.

In rural areas a pole-mount transformer may serve only one customer, but in more built-up areas multiple customers may be connected. In very dense city areas, a secondary network may be formed with many transformers feeding into a common bus at the utilization voltage. Each customer has a service drop connection and a meter for billing.

A ground connection to local earth is normally provided for the customers system as well as for the equipment owned by the utility. The purpose of connecting the customers system to ground is to limit the voltage that may develop if high voltage conductors fall on the lower-voltage conductors or if a failure occurs within a distribution transformer.

III. PROPOSED MODEL

A functional block diagram of distribution network automation with voltage fluctuations and power theft identification is shown in Figure.2. One is feeder station and another one is substation part. The feeder station will be placed in the Transformer pole where the power lines are used for power transmission.

And line man will be having mobile by which receive the information sent by the feeder station using GSM modem about the fault happened in the particular area and the same information will be displayed on LCD provided at the feeder station.

If any fault in this distribution network is detected then controller is going to apply test charge on it’s own at the feeder. Then by this it is going to confirm whether it is permanent fault or temporary fault. If it is temporary fault then controller is going to clear the fault by itself and switches ON feeder. If it is permanent fault then controller is going to isolate the faulty point and it is going to bring up the temporary feeder online.

So by which the losses will be minimized to zero in distribution network and then controller is going to send the information about the fault where it as occurred to substation.
so by which they can make problem correction with shorter time and they can send acknowledgement back to controller where it will switch OFF temporary feeder and close all joints and brings permanent feeder online.

In the feeder station is also going to detect the power theft which will be in the power lines and also to make automatic feeder switching by using microcontroller and relays.

**Hardware Aspects:**

**Microcontroller**: The AT89C52 is a low-power, high-performance CMOS 8-bit microcomputer with 8K bytes of Flash programmable and erasable read only memory. The device is manufactured using Atmel’s high-density nonvolatile memory technology and is compatible with the industry-standard 80C51 and 80C52 instruction set and pinout. The on-chip Flash allows the program memory to be reprogrammed in-system or by a conventional nonvolatile memory programmer. By combining a versatile 8-bit CPU with Flash on a monolithic chip, the Atmel AT89C52 is a powerful microcomputer which provides a highly-flexible and cost-effective solution to many embedded control applications.

**Pulse Generator**: A pulse generator is either an electronic circuit or a piece of electronic test equipment used to generate rectangular pulses. This article describes the test equipment.

**LCD Screen**: A16*2 LCD screen is used to display the warning message and other text messages. 16*2 in the LCD screen indicates that the LCD screen has 2 arrays of line and each array can hold up to 16 characters.

**GSM Modem**: A GSM modem is one of the wireless modem that is devised to work with a GSM wireless network. It works with the same frequency of GSM wireless network. It is an important part of the GSM network.

**Power supply**: The power supply provides regulated 5-V output to power the system microcontroller and drive eight low-side switches. The ac zero-detect circuitry is monitoring the crossover voltage of the mains ac supply. The resultant signal is a low-frequency clock output on the ZVS(Zero-Voltage Detection Signal) based on the ac-line cycle. This information allows the microcontroller to reduce in-rush current by powering loads on the ac-line peak voltage.

**Relay Driver**: The relay subsystem is an electrically-operated switch. The relay switches when the signal coming into the driver is high. It must be connected to a transducer driver subsystem. The relay uses a DPDT relay. Relay use an electromagnetic coil to move the poles of a switch when powered. There are three pairs of connections known as common, normally open and normally closed.

**Transformer**: A Transformer is a device that transfers electrical energy from one circuit to another through inductively coupled conductors- the transformers coils or windings. Expect for air core transformers, the conductors are commonly wound around a single iron-rich core or around separate but magnetically-coupled cores. A current passing through the primary coil creates a magnetic field.

**Voltage Regulator**: A voltage regulator is an electrical regulator designed to automatically maintain a constant voltage level. It is usually having three legs converts varying input voltage and produces a constant regulated output voltage.

**Bridge Rectifier**: A diode bridge is an arrangement of four diodes in a bridge configuration provides the same polarity of output voltage for either polarity of input voltage. When used in its most common application, for conversion of alternating current input into direct current output it is known as a bridge. A bridge rectifier provides full-wave rectification from a two-wire AC input, resulting in lower cost and weight as compared to a center-tapped transformer design.

**Software Aspects:**

a) **Keil**: Keil C51 Compiler gets full use of 8051 register banks. Register banks are useful while processing interrupts and also when using a real time operating system. Keil C51 Compiler use AJMP (Absolute Jump) and ACALL (Absolute Call) instructions.

Keil software snapshot is shown in Figure.3. It is used to develop the program using Embedded C Language and it has inbuilt compiler. This software is widely used for converting Embedded C program into Hex file format. The hex file is dumped into the microcontroller for the required application. Some of the commonly used Keil software development tools are:

- Microvision4 for windows is an integrated development environment
- The C51 ANSI optimizing C Cross compiler
- The A51 macro assembler
- The L51 Linker/Loader
- The LIB51 Library manager

**Software Development cycle:**

- Select the target chip from the device database and configure the tools settings
- Create source files in C or assembly
- Build the application with the project manager
- Correct the errors in source files
- Test the linked applications.

![Figure: 3 Keil software](image-url)
b) Proload: Proload is software which accepts only hex files. Once the machine code is converted into hex code, that hex code has to be dumped into the microcontroller placed in the kit and this is done by the proload. The microcontroller accepts the hex file from the keil compiler and dumps this hex file into the microcontroller which is to be programmed. Proload software snap shot is shown in the Figure: 4

![Proload Software Snap Shot](image)

**Figure: 4 Proload**

c) GSM Commands: The circuit of interfacing GSM to AT89C51 microcontroller mainly consists of GSM modem and 8051 family microcontroller. GSM has RS232 interface for serial communication. In between the GSM module and the microcontroller MAX232 IC is connected. MAX232 IC is used for converting the logic levels. RS232 logic levels of GSM are converted to the TTL logic levels of the microcontroller using this MAX232 IC. MAX232 IC has 16 pins.

This is a dual driver IC as it has two transmitters and receivers. Interfacing of GSM to AT89C51 microcontroller uses only one transmitter and receiver. The transmitter pin T1IN of max232 is connected to the transmitter pin of the microcontroller. The receiver pin R1out of the max232 is connected to the receiver pin of the microcontroller. The T1out pin of the IC is connected to the transmitter pin of the GSM modem. The R1IN pin of the IC is connected to the receiver pin of the GSM modem. GSM Commands as shown in the Table: 1

<table>
<thead>
<tr>
<th>Description</th>
<th>Syntax</th>
<th>Expect Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Set SMS to text mode, as opposed to PDU mode</td>
<td>AT+CMGF=1</td>
<td>OK</td>
</tr>
<tr>
<td>Send an SMS to myself</td>
<td>AT+CMGS= +94639181xxxxx &gt;This is a Test</td>
<td>&quot;CMGR:34 OK&quot;</td>
</tr>
<tr>
<td>Unsolicited notification of the SMS arriving</td>
<td>AT+CMGR=1</td>
<td>&quot;+CMGR:REC UNREAD&quot;, +946391816089V, 02/03/2020 20:40:31 OK This is a test OK</td>
</tr>
<tr>
<td>Read SMS message that has just arrived. Note: The number should be the same as that given in the &lt;CMTI notification&gt;</td>
<td>AT+CMGR=1</td>
<td>&quot;+CMGR:REC READ&quot;, +946391816089V, 02/03/2020 20:40:31 &quot;00 This is a test OK</td>
</tr>
<tr>
<td>Reading the message again changes the status to &quot;READ&quot; from &quot;UNREAD&quot;</td>
<td>AT+CMGR=1</td>
<td>&quot;+CMGR:REC READ&quot;, +946391816089V, 02/03/2020 20:40:31 &quot;00 This is a test OK</td>
</tr>
<tr>
<td>Send another SMS to myself</td>
<td>AT+CMGS= +94639181xxxxx &gt;Test again</td>
<td>&quot;CMGR:35 OK&quot;</td>
</tr>
<tr>
<td>Unsolicited notification of the SMS arriving</td>
<td>AT+CMGR=1</td>
<td>&quot;+CMGR:REC UNREAD&quot;, +946391816089V, 02/03/2020 20:40:31 &quot;00 This is a test OK</td>
</tr>
</tbody>
</table>

Table: 1 GSM Commands

III CONCLUSION

Physical protection is paramount, as in rural and urban areas which are located very far from the electricity board to keep separate technician to check failure like open joint and theft identification in the distribution network. This proposal method is used to monitor these parameters without actual involvement of technician in detecting failure.

The system to make proper power distribution in the electric power lines without any interruption, at the same time system give test charge in the fault line and in case of power failure it automatically switches on power from other feeder by breaking up the fault feeder line and to detect power theft done in power lines by calculating current by consumers.

REFERENCES


