

# AUTOMATIC LOAD SHARING AND POWER THEFT DETECTION USING GSM AND PLC

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## Abstract:

Transformers play a vital role in the power systems, which have to function for 24\*7 to feed the load. In some situations the load may increase beyond the capacity of transformer ratings which may lead to the overloaded conditions that may cause damage of insulation of the transformer. In order to avoid overloading conditions the transformers should be operated in parallel. Whenever the main transformer has to supply beyond its capacity then the sharing transformer will be connected automatically in parallel to the main transformer. And the next major issue faced by the distribution system is power theft. Even after inventing many methods to overcome the power thefts these are still in existence. By using the proposed method one can share the load between the transformers and the power theft can be detected easily in addition to that the electricity e-bill can be generated periodically, if the bill is not paid then that particular consumer can be disconnected by using PLC.

**Keywords:** *overloading, PLC, power theft, e-bill.*

## I. INTRODUCTION:

Electricity is the most basic need for everyone. It has become a necessary element in our daily lives. Electricity has to undergo three stages before it reach to the consumer, these three stages are generation, transmission and finally the distribution stage.

Transformer plays a major role in the process of transmission and distribution. As it is considered to be the most important equipment in the power systems it has to be protected. Whenever a situation arrives in which the transformer has to supply more than its capacity then it undergoes through a condition called overloading. When a transformer undergoes the

taken the entire equipment has to be replaced. In order to avoid the above consequences the extra load should be removed from the transformer. This can be done by operating another transformer in parallel with the main transformer. When the load exceeds a reference value, the second transformer will be automatically connected in parallel with the main transformer and they both share the load. Therefore, two transformers work efficiently under overload condition and the damage can be prevented.

### A. Existing method:

In the existing method of load sharing, load is supplied from a single transformer under normal conditions and a standby transformer is connected in parallel through a circuit breaker. A current transformer measures the load current continuously and compares it with the reference value. Whenever the load current exceeds the reference value then the controller sends high signal to relay, the relay coil thus sends a tripping signal to circuit breaker of standby transformer. Thus, load is shared between the two transformers.

In case of power theft detection the existing method involves a communication system of energy meter with zigbee, relay and GPRS. Zigbee is used for transmission of serial process.

**B. Proposed System:**

By considering the issues faced by the existing system a new system is proposed which provides the solution by using PLC as explained below.

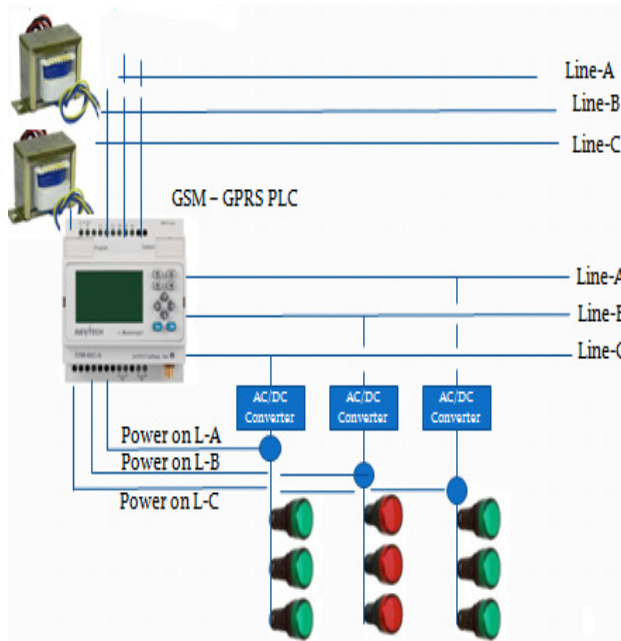


Fig 1: Connection diagram.

In this method a comparator is present one input is considered as capacity of the transformer while the other input is the load which varies according to demand, whenever

the load exceeds beyond the capacity the comparator compares both the values and sends signal to the PLC. Then PLC will automatically connects the slave transformer in parallel to the main transformer. Thus the load is shared between the two transformers. An SMS alert is sent to the authorized person.

A current sensor should be installed in the line in order to detect the power theft in the particular line such that the flowing through can be sensed. It is considered as a variable input which is given to the comparator. The rated current of the line is the fixed value which is given as second input to the comparator. Whenever power theft occurs the line current exceeds the rated current then the comparator compares and sends the signal to PLC and there an SMS alert will be sent to the authorized number as shown in the fig 2.

**II. OPERATION:**

The operation of power theft detection and load sharing is clearly illustrated by the flowchart shown in fig1.

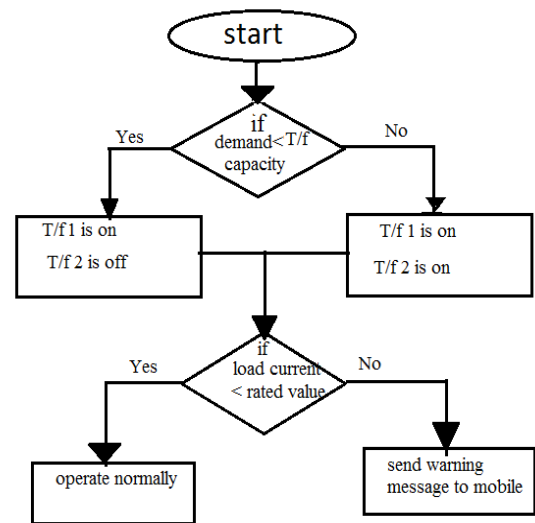


Fig 2 : Flowchart showing the power theft and load sharing operation.

- T/f indicates transformer

The energy meter output is connected to PLC such that the bill is directly sent to the

consumers mobile. If they fail to pay the bill in stipulated time the power supply can be disconnected from the substation through PC by using SCADA.

### III. COMPONENTS :

The components used in this work are Transformers, PLC, communication cable, Load and finally the software required is Supervisory control and data acquisition (SCADA).

#### A. Transformers:

Transformers are the static devices that work on the principle of faraday's law of electromagnetic induction. Transformer is used to either step up or step down the voltage levels during the transmission and distribution of electricity. The transformer used in this particular application is 12VA. The transformer provided with tapings is shown in fig.3.



Fig.3.: Transformer

#### B. PROGRAMMABLE LOGIC CONTROLLER(PLC) :

PLC stands for programmable logic control, it is a special kind of computer that is used for industrial control systems. They are used to monitor the input values and produces the output.

The PLC used in this project is EXM-12DC-DA-R-HMI. It has 4 in built relays. This PLC consists of 4 DI/AI+4DI inputs. GSM module

is inbuilt in the PLC. It is used to send SMS according to the logic of the program.



Fig.4.: PLC

Voltage supplied to PLC is in the range of 12V-24V DC.

#### C. Load:

The part of circuit that consumes electric power is termed as load. There are mainly three types of loads they are resistive loads, inductive loads and capacitive loads.

The loads that are used in our project are 24 watts.

#### D. SCADA:

The software that is used in this project is SCADA. Acquisition of data can be done by using the software, this software is used to monitor the working conditions of equipment. SCADA perform the functions like data acquisition , networked data communication, presentation of data and control. It provides a human interface to the system and automatically regulate the managed system

### IV. RESULTS

#### A. Power theft:

Whenever power theft condition is identified in the system then the SMS alert is sent as shown in fig.5.

Power is being stolen in the Line  
A. Please do site visit.

Fig.5.SMS alert sent regarding power theft

### B. Load sharing

Whenever the main transformer gets overloaded the extra load is shared by other transformer as shown in fig.6.

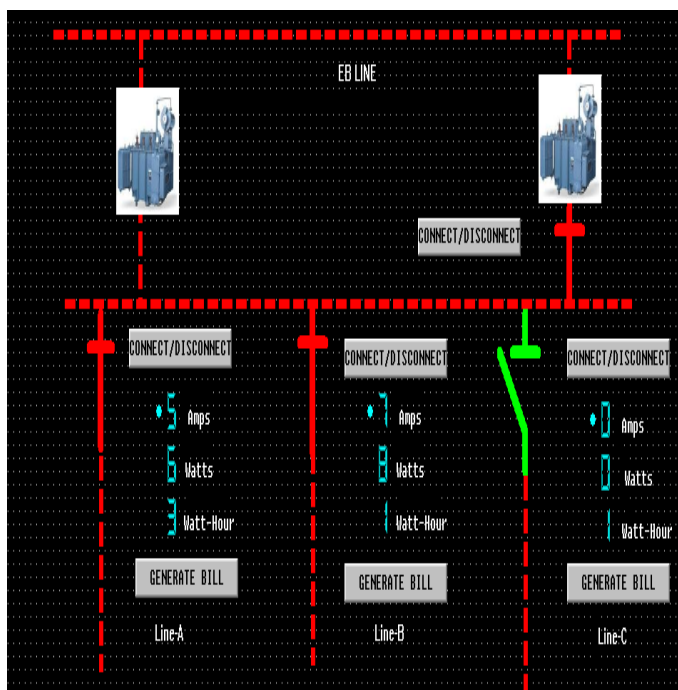


Fig.6.Graphical view for load sharing

Whenever need for load sharing condition is identified in the system then the SMS alert is sent as shown in fig7.

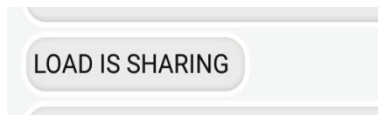


Fig.7. SMS alert regarding load sharing

### C. Smart E-Bill

The energy consumption made by the consumers can be billed and sent to their

mobiles in the form of SMS as shown in below fig.8.



Fig.8.SMS sent to the consumer regarding the electricity consumption

### V. CONCLUSION:

Even though there are many methods to detect electricity theft but they are insufficient to detect exact location of theft therefore it causes lot of revenue loss to the system, the collection of electricity bill has become a huge task these days due to increase in population, this can be made easy by generating bill online and sending the generated bill directly to the consumers.

By using this method the power thefts will be minimized and the risk of damage of the transformers will be reduced. There by loss of revenue can be reduced to the electricity board.

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