Automatic synchronization and power factor rectification of power lines

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Abstract — *In distribution section of power system the power synchronizing and power factor rectification is a main factor analysed by the survey report to decrease the commercial as well as technical loss occurred in power distribution. The commercial loss is that whenever the power get lost by manufacturer, the distributor has to paid the power loss amount to the industrial subscriber through law of justice, in order to overcome this with the help of technical and commercial support, this project helps a lot. In this project the delay time of manual synchronization which is 1 to 2 hrs. can be reduced to 3-4 second as well as the power and cycle losses occurred in distribution after synchronization can be rectified by auto stabilizing method and regenerating of pulses so that losses can be vanished and continuity of power supply can be maintained. This system can also be implemented whenever 3, 4 feeder are connected simultaneously for power feeding in hospitals, bus stand and government sector etc.*

Keywords- Automatic synchronization, power factor rectification, sensing transformer, astable mode, DC converter, Relay driver, Comparator, pulse maker.

I.   INTRODUCTION

This is the problem based project in distribution section of the power system where several producer line is being distributed and they have their own separate loads connected to each other. The problem is that whenever power get lost by any of the producer line then to maintain the continuity of supply to the respective load manual synchronization is prolong which gets delay of 1-2 hrs. approximately. During this period a great production loss has to be bear by the industrial load and by the law of justice the loss of industry has to be reimburse by the distributor, so large amount has to be paid by distributor to the claimed company and another problem is that after synchronization due to sharing of voltage problem of overloading at the load end arises i.e. voltage level and number of cycles goes down.

To overcome this problem automatic synchronization is done within 3 to 4 second with the help of sensing transformer to sense the variation of input voltage, opamp as comparator and microcontroller which controls the switching operation of relay. After the synchronization process to overcome the problem of overloading, voltage is stabilized with the help of auto stabilizing method using autotransformer and frequency is maintained constant to 50 Hz by vanishing the previous cycle and adding it with regenerated 50 Hz cycle using 555 timer and capacitors.

II.   LITERATURE REVIEW

At the latest, when the reasons for power failures or blackouts in which more than one power utility is involved must be analyzed, the importance of accurate and precise time stamps of events becomes visible. Experiences from the past show, that aligning data from different utilities can often take much longer than analyzing the data itself. But also for protection, automation, and control of electric power systems accurate time references are needed. Radio-based time sources like global satellite navigation systems are commonly used and provide precise time. To avoid the requirement of dedicated GPS receivers for each individual device, time distribution systems such as the Network Time Protocol (NTP) [1] or IRIG-B are used. Whereas NTP was already specified in IEC 61850 [2] as time distribution mechanism, it is only suitable in applications for which a time synchronization accuracy in the milliseconds range is sufficient. In contrast, time codes like IRIG-B provide much better performance, but they require the installation of a separate cabling for the distribution of the timing signals. With the implementation of the Precision Time Protocol (PTP), defined in the IEEE 1588 standard [3][4], for the first time a very accurate and safe way to provide time references throughout the power station's Ethernet network is made available. PTP allows distributing reference time information in a local area network like NTP does, but due to the innovative protocol it allows to reach accuracies in the sub-microsecond range.

III. METHODOLOGY

The working of this whole project is divided into two parts. In first part we describes the synchronization process of the power lines and after that we discuss about how the power factor is rectified to maintain the continuity of supply without any interruption with desired voltage and frequency level.

A. Synchronization process

In this process the manufacturer lines are connected to the primary winding of sensing transformer which is 220/12V step down sensing transformer. Fig 1 shows the block diagram of synchronizing process. According to the variation of input, output is changed. The output of transformer is converted into 12V dc by using rectifier. This 12V dc signal is feeded into a comparator which passes the voltages which are under specified limit. After comparator the compared voltage is given to the microcontroller which controls the switching operation of the relay according to the given command. Hence the switching operation between available supplies of producer line is performed by relay and synchronized output is obtained.
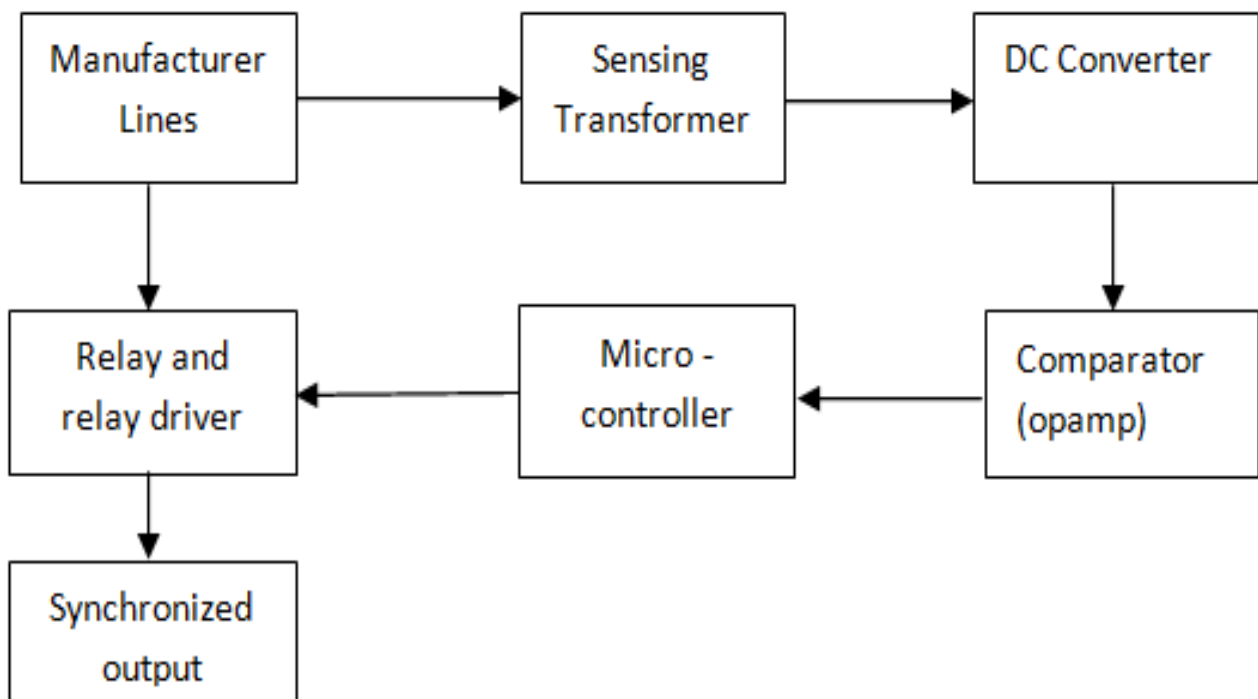

Fig1: block diagram of synchronizing process

B. Power factor rectification process

In this process the synchronized output from the previous process is given to the primary of the autotransformer and also to the primary of a sensing transformer as shown in figure of power factor rectification process. The sensing transformer is 220/12V step down transformer; 12V output power from step down transformer is converted into 12V dc with the help of bridge rectifier. 12V dc from rectifier is given to the comparator LM 324 IC which compares the input voltage with specified required voltage and operates relay driver and relay. Relay performs switching operation between the various tapings of the autotransformer secondary winding and gives required stabilized voltage.

Now cycles of the previous output is vanished and the new 50 Hz cycle is generated with the help of 555 timer in astable mode then added with the vanished cycle using capacitors. The final output obtained is 220V, 50Hz stabilized AC power.
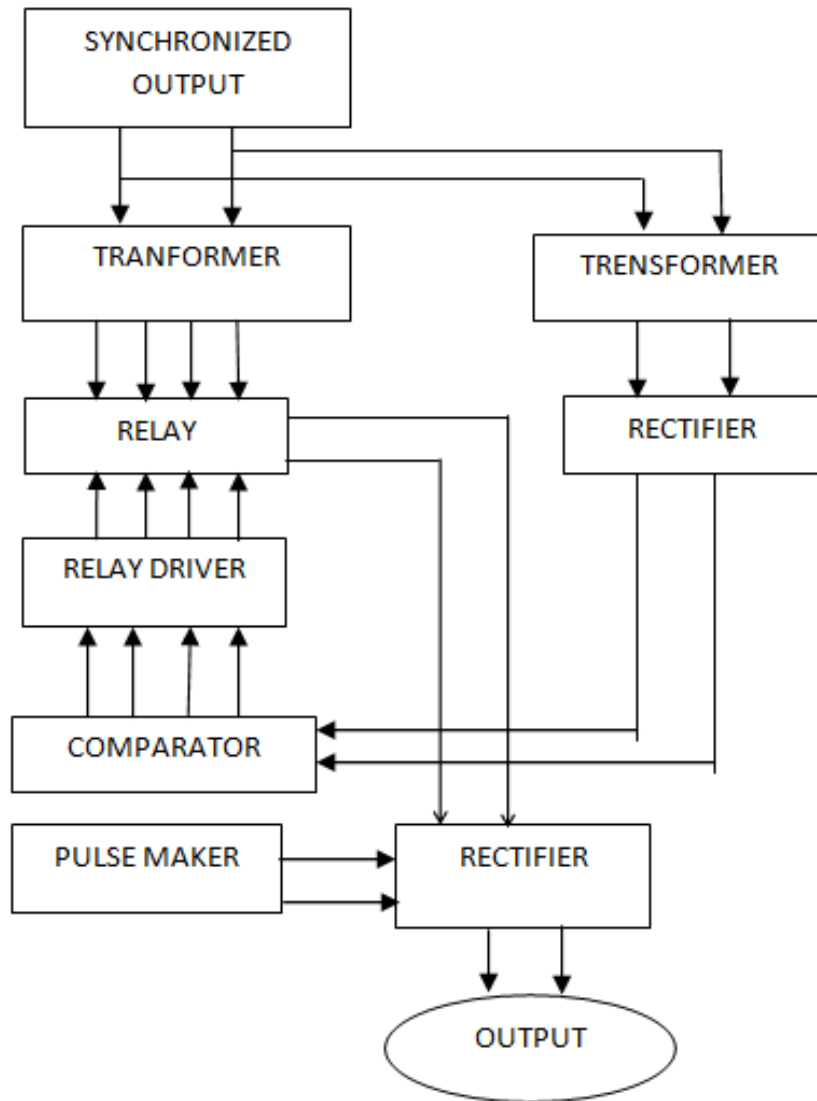
Fig 2: Power factor rectification process

IV.   RESULT AND DISCUSSION

Resultantly the problem due to failure of manufacturer line and problem of overloading are analysed and problem is sorted out. By implementing this project the manual synchronization is converted into automatic synchronization using microcontroller, opamp and relays hence no manpower is required and commercial benefits are increased as well as the synchronizing time which is 1-2 hrs. for manual synchronizing process is reduced upto 3-4 second by using automatic synchronization process. In this project the voltage and frequency level which are reduced due to voltage sharing after synchronization process are boosted up by using power factor rectification process. Resultantly by discussing all the drawbacks and overcoming it one by one, it has been found that this project is more efficient and smart working to assist power grid as well as national grid.

V.   CONCLUSION

Concludingly it has been observed and analysed that this project can be very helpful for the manufacturers and distributors as well as industries to maintain the supply continuously in case of power failure of any of the line. As per the survey report the technical benefit is increased as well as commercial benefit increased because no losses are being claimed by other companies.

The losses occurred due to low voltage and low frequency can be overcome, as well as the problem of overloading, poor voltage regulation is reduced and power factor rectification is achieved efficiently.

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